

## Conservation Strategy Alternative Descriptions

**Note to Reviewers:** This handout describes the Conservation Strategy Alternatives (CSAs) presented at the February 26, 2007 and March 5, 2007 Conservation Strategy Workgroup meetings in greater detail. The description for each CSA includes a theme statement that describes how the alternative will address conservation of the covered fish species, key assumptions that support the theme, and a description of the key alternative elements. Schematic illustrations of major components are presented in the MS Powerpoint handout accompanying this handout. The key alternative elements generally only address the proposed modifications to operations and structural features (e.g., existing facilities and conveyance configurations) and restoration of species habitats. The key alternative elements do not include descriptions of other types of measures that could be common components to all of the CSAs. Examples of these types of common measures include:

1. Reduction in sources of toxics (e.g., point-source and non-point source controls)
2. Harvest of covered species
3. Control of non-native species introductions and populations
4. Regulatory requirements and compliance
5. Hatchery practices

Use of the term “in-Delta” in this handout refers to the limits of the BDCP planning area (i.e., the legal Delta).

### Conservation Strategy Alternative (CSA) 1— Operations Modifications with Existing Conveyance Configuration

**Theme:** Achieve BDCP Conservation Goals within the existing Delta conveyance configuration by improving SWP and CVP operations and facilities management and diversion-related infrastructure to reduce mortality of and improve flow-related habitat conditions for covered fish species sufficiently to increase their production, abundance, and distribution.

#### Key Assumptions:

1. In-Delta levels of entrainment and flow-related habitat conditions are the primary stressors suppressing covered fish species populations.

#### Key Alternative Elements:

1. Real-time operation of CVP and SWP pumps to minimize entrainment of fish during sensitive time periods
2. Improvements to louver facilities at SWP and CVP pumps to minimize fish mortality
3. Improve the SWP/CVP salvage collection, handling, transportation, and release (CHTR) processes to increase survival
4. Modify in-channel habitat structure at SWP/CVP facilities to reduce conditions that support predation of native fishes

5. Improve facilities and pumping operations to minimize passage of fish into Clifton Court Forebay (CCF)
6. Removal and consolidation of in-Delta diversions to minimize entrainment losses of fish
7. Improve the effectiveness of ineffective screened diversions within the Delta
8. Screen un-screened in-Delta diversions
9. Operate the Delta Cross Channel (DCC) to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta
10. Reduce reverse flows in Old River (net westward flow)
11. Re-operation of upstream storage facilities to improve in-stream flows and cold water pool management for benefit of riverine fish and to increase Delta in-flow for benefit of estuarine fish
12. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide shaded riparian area (SRA) overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.

## CSA 2—In-Delta Habitat Restoration under Existing Operations

**Theme:** Achieve BDCP Conservation Goals within the existing Delta conveyance configuration and operations by physically restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient covered species habitat area and quality to increase their production, abundance, and distribution.

**Key Assumption:** The limited extent and quality of in-Delta aquatic and floodplain habitats are the primary stressors suppressing covered fish species populations.

### Key Alternative Elements:

13. Extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
- 14a. Extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>1</sup>
15. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.
16. Manage bypasses within the Delta to improve non-flow related habitat conditions for covered fish species.

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<sup>1</sup> Restored aquatic and floodplain habitats will be designed to provide 1) spawning and rearing habitat for the Delta smelt, longfin smelt (levee setback habitat areas only), and Sacramento splittail and 2) rearing habitat for Chinook salmon, steelhead, and sturgeon.

12. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide shaded riparian area (SRA) overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.

### **CSA 3—Opportunistic Exports with In-Delta (within planning area) Habitat Restoration**

**Theme:** Achieve BDCP Conservation Goals by increasing export capacity and limiting exports to occur only during periods of high flow and when covered fish species are least vulnerable to entrainment; improving flow-related habitat conditions; and restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient habitat area and quality to increase covered species production, abundance, and distribution.

#### **Key Assumptions:**

1. In-Delta levels of entrainment; flow-related, floodplain and aquatic habitat conditions and existing in-Delta freshwater conditions are the primary stressors suppressing covered fish species populations.
2. Improving fluctuating hydrologic conditions by operating the Delta to provide the range of flow and salinity conditions that support covered fish species will increase the extent and quality of flow-related habitat conditions for covered species and will reduce habitat for non-native predator/competitor species and invasive aquatic animal and plant species that adversely affect primary and secondary production and water quality.

#### **Key Alternative Elements:**

17. Increased CVP/SWP pumping capacity to take advantage of high flow episodes with pumping limited at other times when covered species are least vulnerable to entrainment and no pumping at times they are most vulnerable to entrainment
18. Provide flows that improve flow-related habitat conditions that mimic historical hydrological patterns (eg. fluctuating salinity, east-west flow)
19. Increased conveyance capacity south of Delta and additional south-of-Delta storage facilities and infrastructure to opportunistically store high flows, including concurrent improvements to louver facilities to minimize fish mortality
9. Operate the DCC to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta
12. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
13. Extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
- 14a. Extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions

that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>1</sup>

15. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.

#### CSA 4—South Delta Aqueduct (SDA) with In-Delta Habitat Restoration

**Theme:** Achieve BDCP Conservation Goals by creating a new Delta conveyance configuration to provide for improved fluctuating salinities and variable hydrology in the western and northern Delta and improving ecosystem water quality in the South Delta, and restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient covered species habitat area and quality to increase their production, abundance, and distribution.

##### Key Assumptions:

1. In-Delta levels of entrainment; flow-related, floodplain, and aquatic habitat conditions; existing in-Delta freshwater conditions; and extent and quality of in-Delta floodplain and aquatic habitat are the primary stressors suppressing covered fish species populations.
2. Improving fluctuating hydrologic conditions by operating the Delta to provide the range of flow and salinity conditions that support covered fish species will increase the extent and quality of flow-related habitat conditions for covered species and will reduce habitat for non-native predator/competitor species and invasive aquatic animal and plant species that adversely affect primary and secondary production and ecosystem water quality.

##### Key Alternative Elements:

20. Construct and operate a peripheral aqueduct (“South Delta Aqueduct”) from Sacramento River (near Hood) with state of the art screening with discharge into lower San Joaquin River. Diverting water from the Sacramento River near Hood will allow salinities to fluctuate in the western, northern, and eastern Delta. Discharging Sacramento River water into the lower San Joaquin River will improve water quality conditions (e.g., DO) for covered species in the south Delta.
- A. **Interim Elements:** Implement the following actions to maintain and improve covered fish populations during the period required to construct and initiate operation of SDA facilities:
  44. Limited in-Delta levee setbacks and breaching of Delta islands to restore aquatic and floodplain habitats (primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps) to maintain covered species abundance and distribution.<sup>1</sup> Restoration will be conducted in locations that will not preclude larger scale restorations to be implemented when SDA facilities are operational.
  45. Real-time operation of CVP and SWP pumps to minimize entrainment of fish during sensitive time periods
  46. Improve the SWP/CVP salvage collection, handling, transportation, and release (CHTR) processes to increase survival
  47. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.

48. Improvements to louver facilities at SWP and CVP pumps to minimize fish mortality
49. Operate the Delta Cross Channel (DCC) to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta
50. Re-operation of upstream storage facilities to improve in-stream flows and cold water pool management for benefit of riverine fish and to increase Delta in-flow for benefit of estuarine fish
51. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.

**B. Post-Operational Elements:** In addition to the above elements, when SDA is operational:

21. Operate the Delta to reestablish fluctuating hydrologic conditions (salinity, flow, temperature) that benefit covered fish species, including re-operation of upstream storage facilities to support Delta operations
13. Implement extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
- 14a. Implement extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>1</sup>

### **CSA 5—Isolated Facility (IF) with In-Delta Habitat Restoration**

**Theme:** Achieve BDCP Conservation Goals by creating new Delta conveyance configuration to provide fluctuating salinities and variable hydrology throughout the Delta, avoiding entrainment at the pumps, and restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient habitat area and quality of covered species to increase their production, abundance, and distribution.

**Key Assumptions:**

1. In-Delta levels of entrainment; flow-related, floodplain, and aquatic habitat conditions; existing in-Delta freshwater conditions; and extent and quality of in-Delta floodplain and aquatic habitat are the primary stressors suppressing covered fish species populations.
2. Improving fluctuating hydrologic conditions by operating the Delta to provide the range of flow and salinity conditions that support covered fish species will increase the extent and quality of flow-related habitat conditions for covered species and will reduce habitat for non-native predator/competitor species and invasive aquatic animal and plant species that adversely affect primary and secondary production and ecosystem water quality.

**Key Alternative Elements:**

22. Construct and operate an isolated facility (IF) (i.e., “peripheral canal”) from Sacramento River (near Hood) with state of the art screening directly to the pumps to isolate the Delta from CCF and the SWP/CVP pumps.

- A. **Interim Elements:** Implement the following actions to maintain and improve covered fish populations during the period required to construct and initiate operation of IF:
- 44. Limited in-Delta levee setbacks and breaching of Delta islands to restore aquatic and floodplain habitats (primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps) to maintain covered species abundance and distribution.<sup>ii</sup> Restoration will be conducted in locations that will not preclude larger scale restorations to be implemented when conveyance facilities are operational.
  - 45. Real-time operation of CVP and SWP pumps to minimize entrainment of fish during sensitive time periods
  - 46. Improve the SWP/CVP salvage collection, handling, transportation, and release (CHTR) processes to increase survival
  - 47. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
  - 48. Improvements to louver facilities at SWP and CVP pumps to minimize fish mortality
  - 49. Operate the Delta Cross Channel (DCC) to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta
  - 50. Re-operation of upstream storage facilities to improve in-stream flows and cold water pool management for benefit of riverine fish and to increase Delta in-flow for benefit of estuarine fish
  - 51. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.
- B. **Post-Operational Elements:** In addition to continuation of the above elements, when IF is operational:
- 23. Modify DCC gate operations to maximize benefits for covered fish
  - 21. Operate the Delta to reestablish fluctuating hydrologic conditions (salinity, flow, temperature) that benefit covered fish species, including re-operation of upstream storage facilities to support Delta operations
  - 13. Implement extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
  - 14b. Implement extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored in locations that would best benefit covered fish species throughout the Delta.<sup>1</sup>

## **CSA 6—Suisun Marsh Habitat Restoration in Combination with In-Delta Habitat Restoration**

**Theme:** Achieve BDCP Conservation Goals within the existing Delta conveyance configuration and operations by restoring physical aquatic and floodplain habitats within the Delta and Suisun Marsh (outside of the Planning Area) to provide sufficient covered species habitat area and quality to increase their production, abundance, and distribution. This alternative will restore less in-Delta habitat (e.g., 40-60%) than would be restored under CSA 2.

### **Key Assumptions:**

1. The extent and quality of in-Delta floodplain and aquatic habitat and tidal marsh and aquatic habitat conditions in Suisun Marsh are the primary stressors suppressing covered fish species populations.

### **Key Alternative Elements:**

24. Breach dikes in Suisun Marsh to reestablish tidal exchange and create tributary channels necessary to create high quality intertidal marsh and aquatic habitats.<sup>2</sup>
25. Modify operations of salinity control structures in Suisun Marsh to improve flow-related habitat conditions for covered fish in Suisun Marsh.
12. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
13. In-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>3</sup>
- 14a. Restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>2</sup>
15. Improve habitat conditions in Delta locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.

## **CSA 7—Upstream Habitat Restoration in Combination with In-Delta (within planning area) Habitat Restoration**

**Theme:** Achieve BDCP Conservation Goals within the existing Delta conveyance configuration and operations by restoring physical aquatic and floodplain habitats within the Delta and outside the planning area along the Sacramento and San Joaquin Rivers and their tributaries to provide sufficient covered

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<sup>2</sup> Restoration in Suisun Marsh would be undertaken in collaboration with willing participants.

<sup>3</sup> Restored aquatic and floodplain habitats will be designed to provide 1) spawning and rearing habitat for the Delta smelt, longfin smelt, and Sacramento splittail and 2) rearing habitat for Chinook salmon, steelhead, and sturgeon.

species habitat area and quality to increase their production, abundance, and distribution. This alternative will restore less in-Delta habitat (e.g., 40-60%) than would be restored under CSA 2.

**Key Assumptions:**

1. The extent and quality of in-Delta floodplain and physical aquatic habitat and fish passage and aquatic floodplain habitat conditions in upstream areas are the primary stressors suppressing covered fish species populations.

**Key Alternative Elements:<sup>4</sup>**

26. Improving passage and access to upstream habitats, including removing, modifying, or bypassing barriers
27. Restoration of salmonid spawning habitats, including gravel augmentations, providing for channel meander to enhance inputs of spawning gravels, installing barriers to separate Chinook runs
28. Expansion of river floodplain habitat including creation and expansion of new floodways to restore rearing habitat and splittail spawning habitat
29. Isolation of captured gravel pits
30. Installation of screens on river diversions
31. Removal of bank protection to reestablish floodplain processes that support creation and maintenance of spawning and rearing habitat
32. Restoration of riparian habitat including shaded riverine aquatic cover
31. Modified operations to support in-stream flows for spawning and rearing, including bypass habitats, and cold water pool management
12. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
13. In-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
- 14a. Extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>1</sup>
15. Improve habitat conditions in Delta locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.

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<sup>4</sup> Restoration upstream of the BDCP planning area would be undertaken in collaboration with willing participants.



## CSA 8—Bifurcated SDA with In-Delta Habitat Restoration

**Theme:** Achieve BDCP Conservation Goals by altering the existing Delta conveyance configuration to provide for fluctuating salinities and variable hydrology in the western and northern Delta, improving ecosystem water quality in the South Delta, and restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient habitat area and quality of covered species to increase their production, abundance, and distribution.

### Key Assumptions:

1. In-Delta levels of entrainment; flow-related, floodplain, and aquatic habitat conditions; existing in-Delta freshwater conditions; and extent and quality of in-Delta floodplain and aquatic habitat are the primary stressors suppressing covered fish species populations.
2. Improving fluctuating hydrologic conditions by operating the Delta to provide the range of flow and salinity conditions that support covered fish species will increase the extent and quality of flow-related habitat conditions for covered species and will reduce habitat for non-native predator/competitor species and invasive aquatic animal and plant species that adversely affect primary and secondary production and ecosystem water quality.

### Key Alternative Elements:

36. Construct and operate a peripheral aqueduct from the Sacramento River (near Hood) with state of the art screening that is bifurcated at the discharge end: one split discharges into the CCF and isolates the SWP and CVP pumps (smaller discharge than under CSA 5), and the other split discharges into lower San Joaquin River (smaller discharge than under CSA 4). Diverting water from the Sacramento River near Hood will allow salinities to fluctuate throughout the Delta. Discharging Sacramento River water into the lower San Joaquin River will improve water quality conditions (e.g., DO) for covered species in the south Delta.
- A. **Interim Elements:** Implement the following actions to maintain and improve covered fish populations during the period required to construct and initiate operation of SDA facilities:
  44. Limited in-Delta levee setbacks and breaching of Delta islands to restore aquatic and floodplain habitats (primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps) to maintain covered species abundance and distribution.<sup>iii</sup> Restoration will be conducted in locations that will not preclude larger scale restorations to be implemented when SDA facilities are operational.
  45. Real-time operation of CVP and SWP pumps to minimize entrainment of fish during sensitive time periods
  46. Improve the SWP/CVP salvage collection, handling, transportation, and release (CHTR) processes to increase survival
  47. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
  48. Improvements to louver facilities at SWP and CVP pumps to minimize fish mortality
  49. Operate the Delta Cross Channel (DCC) to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta

50. Re-operation of upstream storage facilities to improve in-stream flows and cold water pool management for benefit of riverine fish and to increase Delta in-flow for benefit of estuarine fish
51. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.

**B. Post-operational Elements:** In addition to the above elements, when SDA is operational:

37. Limited exports continued from existing South Delta facilities
13. Implement extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
- 14a. Implement extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps.<sup>1</sup>
21. Operate the Delta to reestablish fluctuating hydrologic conditions (salinity, flow, temperature) that benefit covered fish species, including re-operation of upstream storage facilities to support Delta operations

### **CSA 9—Dual Conveyance with In-Delta (within planning area) Habitat Restoration**

**Theme:** Achieve BDCP Conservation Goals by altering the existing Delta conveyance configuration to provide flexibility in Delta operations to reduce effects of operations-related entrainment; improve fluctuating hydrologic conditions for covered fish species while maintaining in-Delta channel stage and water quality; and restoring extensive tracts of physical aquatic and floodplain habitats within the Delta to provide sufficient covered species habitat area and quality to increase their production, abundance, and distribution.

**Key Assumptions:**

1. In-Delta levels of entrainment; flow-related, floodplain, and aquatic habitat conditions; and existing in-Delta freshwater conditions are the primary stressors suppressing covered fish species populations.
2. Improving fluctuating hydrologic conditions by operating the Delta to provide the range of flow and salinity conditions that support covered fish species will increase the extent and quality of flow-related habitat conditions for covered species and will reduce habitat for non-native predator/competitor species and invasive aquatic animal and plant species that adversely affect primary and secondary production and ecosystem water quality.

**Key Alternative Elements:**

38. Improvements/maintenance of through Delta conveyance facilities (e.g., reinforcing levees, dredging to maintain channel capacity).
  39. Construct and operate a peripheral aqueduct from Sacramento River (near Hood) of lesser capacity than under CSA 5 directly to the pumps to isolate the Delta from CCF and the SWP/CVP pumps.
- A. Preoperational Elements:** Implement the following actions to maintain and improve covered fish populations during the period required to construct and initiate operation of the peripheral aqueduct facilities:

44. Limited in-Delta levee setbacks and breaching of Delta islands to restore aquatic and floodplain habitats (primarily in the northern and eastern Delta to avoid adverse salinity effects on water quality at pumps and in other locations that will not affect water quality at the pumps) to maintain covered species abundance and distribution.<sup>iv</sup> Restoration will be conducted in locations that will not preclude larger scale restorations to be implemented when IF facilities are operational.
  45. Real-time operation of CVP and SWP pumps to minimize entrainment of fish during sensitive time periods
  46. Improve the SWP/CVP salvage collection, handling, transportation, and release (CHTR) processes to increase survival
  47. Design in-Delta levee maintenance projects to incorporate features that improve in-channel habitat conditions (e.g., establishment of riparian vegetation on levee slopes to provide SRA overhead cover, creation of levee benches to create shallow inter-tidal and subtidal habitat areas, incorporation of large wood debris into riprap within the intertidal and subtidal portions of the levee cross section). Actions of this measure are limited to opportunities presented by levee maintenance needs.
  48. Improvements to louver facilities at SWP and CVP pumps to minimize fish mortality
  49. Operate the Delta Cross Channel (DCC) to improve passage of Sacramento River steelhead and salmon and minimize adverse effects on Sacramento River fish associated with moving into the Central Delta
  50. Re-operation of upstream storage facilities to improve in-stream flows and cold water pool management for benefit of riverine fish and to increase Delta in-flow for benefit of estuarine fish
  51. Improve habitat conditions in locations where covered fishes are highly vulnerable to predation to create habitat conditions that will reduce predation levels.
- B. **Post-Operational Elements:** In addition to continuation of the above elements, when the peripheral aqueduct is operational:
40. Operate the Delta to reestablish fluctuating hydrologic conditions (salinity, flow, temperature) that benefit covered fish species, though not to the extent under CSA 4 and 5, including re-operation of upstream storage facilities to support Delta operations
  13. Implement extensive in-Delta Levee setbacks in important covered fish use areas to establish intertidal and subtidal aquatic and floodplain habitats.<sup>1</sup>
  - 14a. Implement extensive restoration of aquatic and floodplain habitats on existing farmed islands by breaching levees to reintroduce tidal flow and elevating island interiors to elevations that will support desired covered species habitats. Island habitats will be designed to provide a diversity of habitats to ensure that the range of habitats conditions required for covered fishes are established and to create conditions that will maximize food production. Islands will be restored in locations that would best benefit covered fish species throughout the Delta.<sup>1</sup>

### CSA 10—Split Delta with San Joaquin River Corridor Restoration

**Theme:** Achieve BDCP Conservation Goals by operating and reconfiguring in-Delta conveyance of San Joaquin River to isolate covered fish species from the South Delta pumps and restoring estuarine habitat in the south and west Delta to provide sufficient covered species habitat area and quality to increase their production, abundance, and distribution.

**Key Assumptions:**

1. In-Delta levels of entrainment and extent and quality of flow-related aquatic habitat along the San Joaquin River conveyance corridor are the primary stressors suppressing covered fish species populations.

**Key Alternative Elements:**

41. Divide the Old River channel to allow San Joaquin River flow to be separated from Victoria Canal water supply flows and install structures to regulate flows such that San Joaquin River flows are separated from the pumps and allowed to pass to the central Delta.
  42. Open the DCC and install screens at the DCC and Georgiana Slough to prevent passage Sacramento River fish into the Central Delta and reconfigure in-Delta conveyance to create a water supply corridor toward the SWP and CVP using the DCC, rock barriers, floodgates, siphons, and pumps.
  43. Operate Split Delta conveyance facilities to provide transport flows for juvenile Delta smelt and improve salinity conditions for estuarine fish along the lower San Joaquin River to Franks Tract
3. Improve the SWP/CVP salvage facilities
-